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Research Article

### THE DEPRESSION AND ANXIETY ASSESSMENT AMONG WOMEN WITH HIGH BODY MASS INDEX WHO ATTENDING PRIMARY HEALTH CARE CENTERS IN TAIF CITY

Dr. Wafaa Altaezi<sup>1</sup>, Dr. Hani Aloufi<sup>2</sup>, Dr. Mohammed AlTaezi<sup>3</sup>, Dr. Mohammed Mahboob<sup>4</sup>

<sup>1</sup>Researcher, Family Medicine Resident, MBBS

<sup>2</sup>Family Medicine Consultant, MBBS, ABFM, MD

<sup>3</sup> General Practitioner, MBBS

<sup>4</sup> Saudi Board Internal Medicine, MBBS

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**Abstract:**

**Background:** Obesity is the most common chronic physical illness in modern society, and depression is the most prevalent psychological condition.

**Objectives:** To evaluate and assess the psychological impacts of depression and anxiety among women with high body mass index.

**Subjects and methods:** A cross-sectional study was conducted in Taif city, Western Saudi Arabia among a random sample of adult females aged

≥18 years old with high body mass index ( $\geq 25$  kg/m<sup>2</sup>) presented in primary health care centers during the period February-July, 2019. Data were collected using a questionnaire including the socio-demographic data, the body mass index, as well as Patient Health Questionnaire-9 items (PHQ-9) and Generalized Anxiety Disorder 7-item (GAD-7) to assess depression and anxiety, respectively.

**Results:** The study included 384 women. The age of almost one-third of them either ranged between 41 and 50 years (35.4%) or exceeded 50 years (32%). About 59.4% of the participants were overweight while the remaining 40.6% were obese. Overall, mild and moderate levels of anxiety were reported among 30.7% and 0.8% of the adult females, respectively while severe anxiety was not reported among anyone.

Multivariate logistic regression analysis revealed that after controlling for confounders, obese females were at higher risk for anxiety compared to overweight group (Adjusted odds ratio "AOR"=2.49; 95% confidence interval "CI"=1.47-4.24,  $p=0.001$ ). Apart from BMI, single marital status and history of chronic diseases were significant predictors for anxiety among overweight/obese women. The prevalence of depression was 46.6%; being mild among 35.7% and moderate or moderately severe among 10.9% of them. Multivariate logistic regression analysis revealed that after controlling for confounders, obese females were at almost three-fold risk for depression compared to overweight group (AOR=3.19; 95% CI=1.89-5.37,  $p<0.001$ ). Other indicators for depression apart from BMI were non-Saudi nationality ( $p<0.001$ ), illiterate status ( $p$ -value ranged from 0.043 to 0.001), being house wife ( $p=0.005$ ) and having low income ( $p$  value ranged from 0.006-0.002).

**Conclusion:** Depression and anxiety are common psychiatric health problems among adult overweight/obese females with obese females were at higher risk for both problems than overweight females.

**Corresponding author:****Dr. Wafaa Altaezi,***Researcher, Family Medicine Resident, MBBS*

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**1. INTRODUCTION:****1.1 Background**

Obesity is one of the greatest public health challenges of the 21<sup>st</sup> century and it is also rapidly increasing among women of childbearing age.<sup>1</sup> The most accessible, simple and widely used diagnosis measure of obesity is body mass index (BMI). The formula for BMI is weight in kilograms divided by height in meters squared and while it is normal between 18.5 and 24.9 and overweight between 25 and 29.9, it is considered as obesity when the values are 30 and above.<sup>2</sup>

Obesity is the most common chronic physical illness in modern society, and depression is the most prevalent psychological condition.<sup>3</sup> The increasing prevalence of overweight and obesity is a major public health concern. Among US adults, prevalence of obesity increased from approximately 23% in 1990 to 31% in 2000.<sup>4</sup>

Obesity is increasingly prevalent and associated with numerous health complications including hypertension, coronary heart disease, and increased mortality.<sup>5</sup> On the other hand according to the World Health Organization (WHO), depression is among the leading causes of disability and affecting about 121 million people globally at each moment in time<sup>6</sup> and it is causing huge burden of disease and enormous economic costs, worldwide.<sup>7</sup> Longitudinal studies have found that obesity predicts the subsequent onset of depression.<sup>8</sup> Obese children and adolescents are subjected to social rejection, discrimination and negative stereotyping and such experiences could be expected to lead to negative consequences in terms of self-image, self-esteem and mood, and there is a widespread assumption that obesity has profound psychological costs.<sup>9</sup> Many studies have shown an increase in the prevalence of depression and psychological illness in obese subjects although the nature of the relationship remains unclear.<sup>10, 11</sup> For example Lee et al<sup>12</sup> found that obesity at baseline was associated with being depressed at follow-up 5 years later. They demonstrated that obesity was able to predict subsequent depression and

their findings suggest a probable causal relationship between obesity and subsequent depression, but didn't support the idea that depression predicts subsequent obesity.

To evaluate the relationship between obesity and a range of mood and anxiety in the US general population, Druss and his colleagues<sup>4</sup> found that obesity is associated with an approximately 25% increase in odds of mood and anxiety disorders and they demonstrated that variation across demographic groups suggests that social or cultural factors may moderate or mediate the association between obesity and mood disorder.

**1.2 The aim of study:**

- To evaluate the psychosocial impacts of high body mass index among women in Taif city.

**1.3 Study rationale:**

- Obesity is the most common chronic physical illness in the modern society, and the increasing prevalence of overweight and obesity is a major public health concern.
- The overweight and obesity affecting the psychological life of women.
- Up to the researcher knowledge, no study had been conducted for evaluate the psychological impact in women with high body mass index in Taif city.

**Specific Objectives:**

1. Evaluate and assess the psychological impacts of depression and anxiety among women with high body mass index.

**Literature Review**

Natascha-Alexandra in 2018 try to Objectives Identifying the underlying pathways between obesity and depression and which individuals with obesity are at risk for developing depressive symptoms is important for improving prevention and treatment efforts. The current study investigated appearance evaluation as a potential mediator of the relationship between obesity and depression.

### Methods

A total of 1,000 participants with a self-reported BMI greater than 30 kg/m<sup>2</sup> were interviewed about their experiences with an elevated body weight and completed measures on appearance evaluation and depression.

### Results

A negative relationship between satisfaction with appearance and BMI and a negative association between satisfaction with appearance and depression was found in men and women. Men reported less depressive symptoms and higher satisfaction with appearance compared to women. While no mediation effect could be determined in women, satisfaction with appearance mediated the obesity-depression relationship in men.

### Conclusions

Efforts to reduce adverse effects of either obesity or depression need to take the reciprocal relationship between the two conditions into account. The current findings underscore the importance of appearance evaluation for treatment efforts in individuals with obesity. Interventions addressing body image might improve both, psychological distress and weight management efforts in general. Identifying the underlying pathways between obesity and depression and which individuals with obesity are at risk for developing depressive symptoms is important for improving prevention and treatment efforts. The study investigated appearance evaluation as a potential mediator of the relationship between obesity and depression. *For the purpose of this study* a total of 1,000 participants with a self-reported BMI greater than 30 kg/m<sup>2</sup> were interviewed about their experiences with an elevated body weight and completed measures on appearance evaluation and depression. *The study indicated* a negative relationship between satisfaction with appearance and BMI and a negative association between satisfaction with appearance and depression was found in men and women. Men reported less depressive symptoms and higher satisfaction with appearance compared to women. While no mediation effect could be determined in women, satisfaction with appearance mediated the obesity-depression relationship in men.<sup>9</sup>

Similar study conducted in England to examine whether the adverse effect of obesity on psychological well-being can be explained by weight discrimination. A sample included 5056 older (≥50 y) men and women living in England and participating in the English Longitudinal Study of Ageing. Participants reported experiences of weight discrimination in everyday life and completed measures of quality of life (CASP-19 scale), life satisfaction (Satisfaction With Life Scale), and

depressive symptoms (eight-item CES-D scale). Height and weight were objectively measured, with obesity defined as BMI ≥30 kg/m<sup>2</sup>. Mediation analyses were used to test the role of perceived weight discrimination in the relationship between obesity and each psychological factor. The study indicated that obesity, weight discrimination, and psychological well-being were all significantly inter-related. It also concluded that perceived weight discrimination explains a substantial proportion of the association between obesity and psychological well-being in English older adults. Efforts to reduce weight stigma in society could help to reduce the psychological burden of obesity.<sup>10</sup>

Yoonhee Choi et al in 2015 carried out a study to investigate the association between psychological factors and body image misperception in different age groups of adult Korean women with a normal weight. On a total of 4,600 women from the Korea National Health and Nutrition Examination Survey 2007-2009, a self-report questionnaire was used to assess body weight perception and 3 psychological factors: self-rated health status, stress recognition, and depressed mood. The study found that a high recognition rate of severe stress were related to body weight misperception which could suggest tailored intervention to adult women especially women in younger age or low self-rated health status or a high recognition rate of severe stress<sup>(11)</sup>.

A cross-sectional study conducted by Jia-In Lee in 2014 to examine the associations between body weight and mental health indicators including depression. The body mass index (BMI) of 5254 adolescents was calculated based on self-reported weight and height measurements. Body weight status was determined by the age- and gender-specific International Obesity Task Force reference tables. By using participants of average weight as the reference group, the association between body weight status (underweight, overweight, and obesity) and mental health indicators were examined by using multiple regression analysis found that there were significant differences in the four mental health indicators were found between those who were overweight<sup>(12)</sup>.

Jafar Askari et al in 2013 conducted study to investigate the relationship between obesity and depression. A sample of 400 subjects aged 16-50 including 200 obese individuals with Body Mass Index (BMI) higher than 30 and 200 normal weight individuals with BMI around 19-24 were chosen from among those who had referred to Yazd health centers in Iran. Body Mass Index (BMI) formula was used to assess obesity and Beck Depression Inventory (BDI)

was used to measure depression. The data were analyzed through variance analysis. Results: The finding of the present study showed that obesity does not lead to a statistically significant increase in depression rate<sup>(13)</sup>.

Eliana M. Perrin and his colleagues in 2010 implemented a study to examine sex- and race/ethnicity-specific relationships between adolescents' and weight perception. , found that 25.1% and 8% of normal weight females and males, respectively, perceived themselves as overweight, with variation by race/ethnicity. Low satisfaction<sup>(14)</sup>.

An article conducted by E Atlantis and & M Bakerb in 2013 following a systematic review of epidemiological studies to determine whether obesity causes depression indicate the presence of some relationship between obesity and depression where 24 studies out of approximately 4500 potentially relevant studies were reviewed; 4 were prospective cohort studies and 20 were cross-sectional studies (10 from the United States). Effect measures reported in all prospective cohort studies were consistent and suggested that obesity may increase the odds of future depression outcomes. Effect measures reported in most cross-sectional studies from the United States supported the hypothesized association between obesity and prevalence of depression outcomes for women but not men, in contrast most cross-sectional studies from populations other than the United States consistently failed to find such associations<sup>(15)</sup>.

To evaluate the relationship between obesity and a range of mood and anxiety in the US general population, Simon and his colleagues found in 2006 that obesity is associated with an approximately 25% increase in odds of mood and anxiety disorders and they demonstrated that variation across demographic groups suggests that social or cultural factors may moderate or mediate the association between obesity and mood disorder<sup>(8)</sup>.

Similar by Gary D in 2012 who review summarizes studies on the psychological effects of weight cycling (i.e., weight loss and regain) in obese persons and proposes an agenda for future research on this topic. Among general psychological constructs, the current literature suggests that weight cycling is not associated with depression, other psychopathology, or depressogenic cognitive styles. Weight cycling is associated with decreased perceptions of health and well-being, although the clinical significance of this relationship is uncertain. Among weight- and eating-related constructs, weight cycling does not appear to be related to restraint, hunger, or personality traits associated with eating disorders. Weight cycling,

however, does appear to be associated with clinically significant reductions in eating self-efficacy and weak but consistent increases in binge eating severity. Definitive conclusions about the presence or absence of the psychological consequences of weight cycling are premature, given the small number of studies, as well as a variety of methodological and interpretive concerns. A new generation of research is necessary to determine the extent and nature of the psychological sequelae of weight cycling<sup>(16)</sup>.

Jane Wardle in 2005 examines the most recent empirical evidence on the relationship between childhood obesity and body dissatisfaction and depression. Studies of clinical samples typically report poorer psychological well-being in treatment seekers when compared with population-based obese and normal weight controls. However, research in community samples suggested that despite moderate levels of body dissatisfaction, few obese children are depressed. A number of important moderators and mediators of the association between obesity and well-being have emerged, with females<sup>(17)</sup>,

A two-wave, 5-y-observational longitudinal studies conducted by R E Roberts and his colleagues in 2003 to examine the temporal relation between obesity and depression to determine if each constitutes a risk factor for the other have found that obesity predicts the subsequent onset of depression<sup>(5)</sup>

Previous study on One hundred ten men and women in a residential weight control facility completed the Multidimensional Body Self-Relations Questionnaire, the Beck Depression Inventory, the Rosenberg Self-Esteem Scale, and the Binge Eating Scale to know body image if considered as a potential mediator of the relationship between obesity and psychological distress found that for both men and women, body-image satisfaction partially mediated the relationship between degree of overweight and depression<sup>(18)</sup>.

Jacqueline study in 2000 aimed to determine whether overweight female adolescents differ from normal and underweight female adolescents with respect to a set of psychosocial factors, while controlling for body image. To achieve the aim of this study 3197 female were selected for analysis. Multivariate Analysis of Variance (MANOVA) was used to test whether overweight subjects differed from normal and underweight subjects with respect to measures of depression.

The study revealed significant differences between groups on the combined set of psychosocial factors<sup>(19)</sup>.

One study sought to test the relationships between relative body weight and clinical depression, suicide ideation, and suicide attempts in an adult US general population sample. About 40,086 African American and White participants interviewed in a national survey. Outcome measures were past-year major depression, suicide ideation, and suicide attempts diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition. The primary predictor was relative body weight, treated both continuously (i.e., body mass index [BMI]) and categorically in logistic regression analyses. Covariates included age, income and education, disease status, and drug and alcohol use. The study found that relative body weight was associated with major depression, suicide attempts, and suicide ideation, although relationships were different for men and women. Among women, increased BMI was associated with both major depression and suicide ideation<sup>(20)</sup>.

## 2. MATERIALS AND METHODS:

### 2.1 Study setting:

The study was conducted in Taif city, in the western region of Saudi Arabia. It is located in the Makkah Province at an elevation of 1700-2500 meters above sea level. The estimated population is  $\approx 1,750,00$  according to 2014 census. In Taif, there are (120) primary health care centers 19 inside the city. This study was conducted in the primary health care centers inside the Taif city.

### 2.2 Study population:

The study population was all adult female who are  $\geq 18$  years old with high body mass index ( $\geq 25$  kg/m<sup>2</sup>) presented in primary health care centers in Taif city.

#### 2.2.1 Inclusion criteria:

All adult female who are  $\geq 18$  years old and have high body mass index of overweight (25.0-29.9 Kg/m<sup>2</sup>) and obese/morbid ( $\geq 30$  Kg/m<sup>2</sup>) were included in the study.

#### 2.2.2 Exclusion criteria:

2.2.2.1 Pregnant women.

### 2.3 Type of the study:

A cross-sectional study

### 2.4 Study duration:

Data were collected starting of February, 2019 and continued till the total collection of the required sample (July, 2019).

### 2.5 Sample size:

The minimal required sample size was calculated by using EPI info version 7 software.

For the purpose of this study among all women who visit the primary healthcare centers during the period

of this study were selected. Keeping 5% as a tolerable error, and assuming a confidence level of 95%.

Accordingly, the total number of registered women in all 19 PHCCs approximately 285,035. Then, estimated the sample size number was 384, and determine the number of sample size for each PHCCs depending on population density.

### 2.6 Sampling technique:

All women, who attending the 19 PHCCs inside the taif city and met the inclusion criteria were eligible, in each center the target population were selected by systematic random technique.

### 2.7 Data collection tool:

Data were collected by the study team from targeted audiences by using well designed questionnaire, which was validated by family medicine and community medicine consultants.

The questionnaire included in the first section the socio-demographic data such as age, residence, marital status, level of education, occupation and income. The second section includes the height, weight, from which the body mass index was calculated. Third part assesses the psychological impacts which include depression based on Patient Health questionnaire-9 items (PHQ-9) and anxiety by using Generalized Anxiety Disorder 7-item (GAD-7). Fourth part covers the co-morbidities.

Regarding the third part, GAD-7 scale was utilized in to assess anxiety symptom severity among the participants. It is a practical self-reported questionnaire with proved validity among primary care and general population.<sup>21,22</sup> Scoring of GAD-7:

Scores of 0, 1, 2, and 3 were assigned to the response categories; "not at all," "several days," "more than half the days," and "nearly every day," respectively. the total score ranged between 0 and 21.

0-4 indicates minimal anxiety 5-9 indicates mild anxiety 10-14 indicates moderate anxiety 15-21 indicates severe anxiety

The PHQ-9 questionnaire (Arabic version) composed of 9 statements is a multipurpose instrument used for screening, diagnosing, monitoring and measuring the severity of depression. It has a 61% sensitivity and a 94% specificity in adults.<sup>23-25</sup>

The PHQ-9 has 9 statements with a score ranging from 0 to 3 for each statement (total score ranging from 0 to 27). The provisional diagnoses of depression, based on the total score was described by Liu, et al as follows:<sup>24</sup>

PHQ-9 score	Severity
0-4	None
5-9	Mild depression
10-14	Moderate depression
15-19	Moderately severe depression
20-27	Severe depression

PHQ-9 is available free online; however, permission to use the Arabic version will be requested from the corresponding author.

### 2.8 Statistical data analysis:

All statistical analyses were conducted using Statistical Package for Social Sciences (SPSS 26). Collected data were described in the form of frequency and percentage as all were categorical variables. Chi-square test was applied for bivariate analysis. Multivariate logistic regression analysis was conducted to look for the association between overweight/obesity and both of depression and anxiety after controlling for the confounding effect and results were expressed as adjusted odds ratio (aOR) and 95% confidence interval (CI). Statistical analysis was performed with the help of an expert statistician and was interpreted in an explorative way. P-value <0.05 and 95% CI doesn't include one were considered for statistical significance.

### 2.9 Ethical approval:

- The study proposal was approved by the Regional Research and Ethics committee of family medicine residency program in MOH Taif
- Permission of the director of primary health care centers in Taif was obtained.

- A verbal consent was obtained from each participant prior to study conduction.
- All collected data were treated confidentially and were used only for the purpose of research.

### 2.10 Budget:

The study was self-funded.

### 2.11 Benefits of study:

- The study provides good and valid information about the effect of high body mass index on psychological life of women.
- To improve the quality of life and to go forward a healthy lifestyle.
- Other researchers might be interested in the study findings to use it in their future purposes.
- To be published.

## 4. RESULTS:

The study included 384 women of body mass index exceeded 25 Kg/m<sup>2</sup>. Table 1 summarizes their socio-demographic characteristics. The age of almost one-third of them either ranged between 41 and 50 years (35.4%) or exceeded 50 years (32%). More than half of them (53.4%) were married and majority (86.2%) were Saudi nationals. More than one-quarter of them (28.6%) were university graduated or above. Majority of the participants (81%) were house wives and the income of 60.5% of them ranged between 5000 and 10000 SR/month. Table 1

**Table 1: Socio-demographic characteristics of the overweight obese adult females, Taif city**

	Frequency	Percentage
<b>Age (years)</b>		
18-25	21	5.5
26-35	40	10.4
36-40	64	16.7
41-50	136	35.4
>50	123	32.0
<b>Marital status</b>		
Single	32	8.3
Married	205	53.4
Divorced	70	18.2
Widowed	77	20.1
<b>Nationality</b>		
Saudi	331	86.2
Non-Saudi	53	13.8
<b>Educational level</b>		
Illiterate	36	9.4
Primary school	14	3.6
Intermediate school	66	17.2
Secondary school	158	41.1
University/above	110	28.6
<b>Occupation</b>		
House wife	311	81.0
Worker	73	19.0
<b>Income (SR/month)</b>		
<5000	19	4.9
5000-10000	232	60.5
10001-15000	129	33.6
>15000	4	1.0

**Frequency of overweight and obesity**

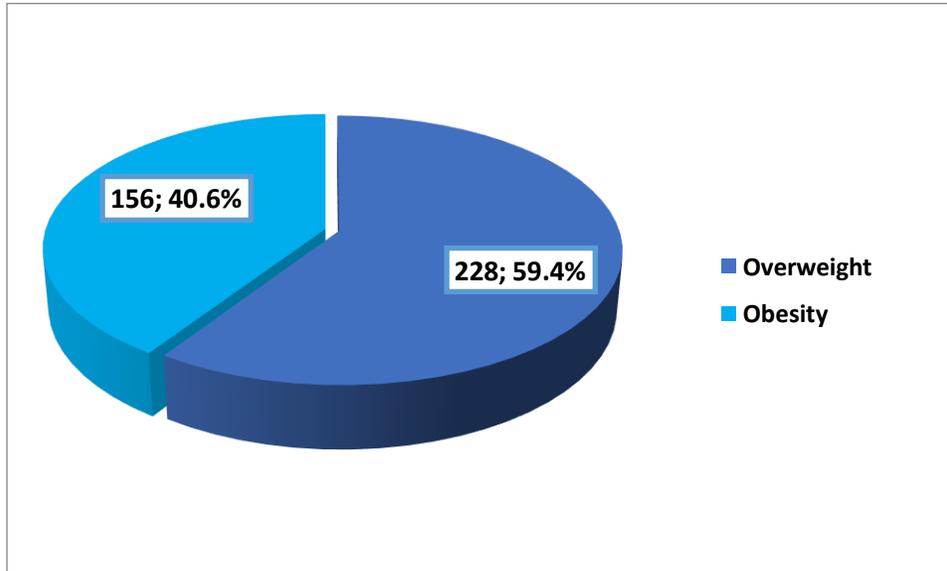
As shown in Figure 1, 59.4% of the participants were overweight while 40.6% were obese.

**History of chronic illness**

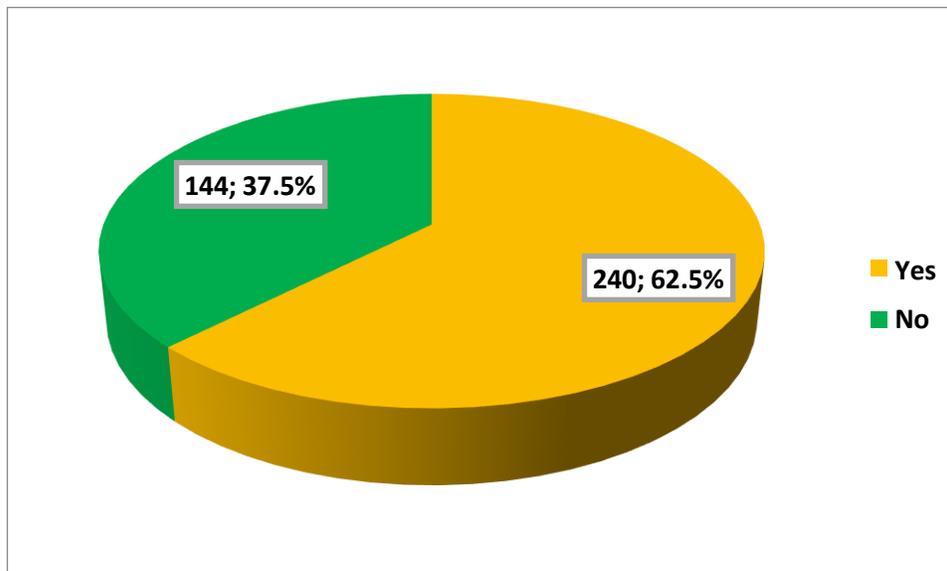
History of chronic illness was reported about two-thirds of the participants (62.5%). Figure 2

**History of being on medication**

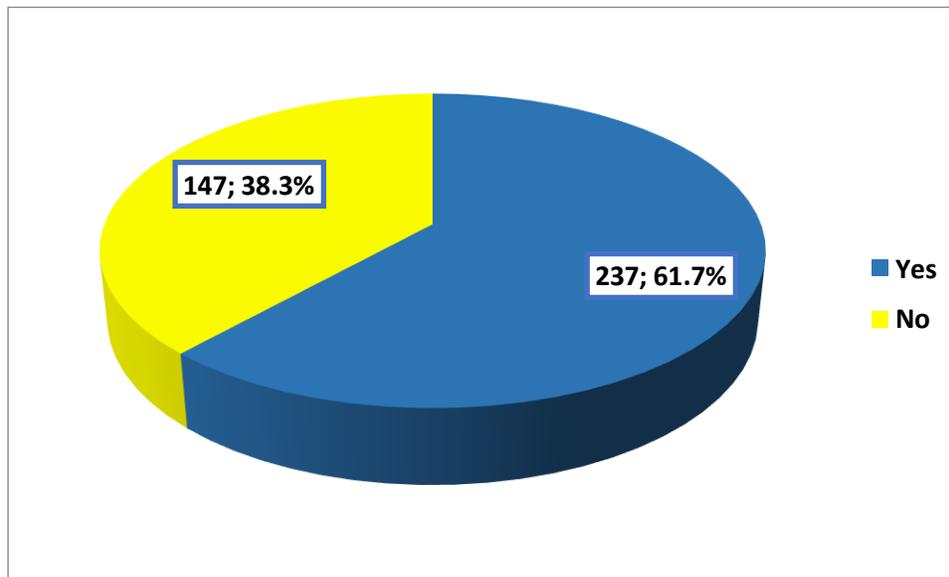
From Figure 3, it is clear that most of the participants (61.7%) were on medication.



**Figure 1: Frequency of overweight and obesity among adult females, Taif city**



**Figure 2: History of chronic health problems among overweight or obese adult females, Taif city**



**Figure 3: History of being on medication among overweight or obese adult females, Taif city**

#### Anxiety

Almost one-fifth of the participants (20.3%) were worried too much about different things and 19% became easily annoyed or irritable most of the days or every day during the last two weeks. On the other hand, majority of them never feeling afraid, as if something awful might happen (83.6%) or being so restless that it is hard to sit still (80.2%) during the last two weeks.

Overall, mild and moderate levels of anxiety were reported among 30.7% and 0.8% of the overweight/obese adult females, respectively while severe anxiety was not reported among anyone. Figure 4

Mild anxiety was reported among almost half of the widowed participants (51.9%) and moderate level was observed among 2.6% of them compared to 27.8% and none of married females, respectively,  $p < 0.001$ . Minimal anxiety was reported among all women whose income was less than 5000 SR/month compared to 62.5% of those whose income ranged between 5000 and 10000 SR/month,  $p = 0.001$ . Table 3

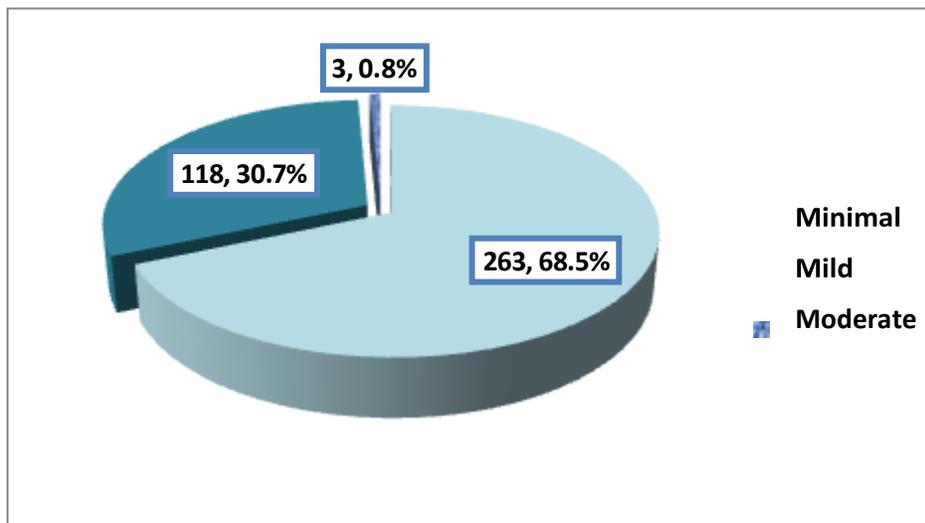
Mild and moderate levels of anxiety were more reported among obese than overweight adult females (46.2% and 1.9% versus 20.2 and none, respectively),  $p < 0.001$ . Table 4

Females with history of chronic diseases were more likely to have mild and moderate anxiety compared to those without such history (39.2% and 1.3% versus 16.7% and none, respectively,  $p < 0.001$ ). Similarly, females with history of being on medication were more likely to have mild and moderate anxiety compared to their counterparts (38.4% and 1.3% versus 18.4% and none, respectively,  $p < 0.001$ ). Table 5

Multivariate logistic regression analysis revealed that after controlling for confounders, obese females were at higher risk for anxiety compared to overweight group (Adjusted odds ratio AOR = 2.49; 95% confidence interval "CI" = 1.47-4.24,  $p = 0.001$ ). Apart from BMI, single marital status and history of chronic diseases were significant predictors for anxiety among overweight/obese women. Table 6

**Table 2: Response of the participants to items of Generalized Anxiety Disorder 7-item (GAD-7) scale over the last two weeks**

Over the last two weeks, how often have you been bothered by the following problems?	Not at all N (%)	Several days N (%)	More than half the days N (%)	Nearly every day N (%)
Feeling nervous, anxious, on edge	216 (56.3)	150 (39.1)	13 (3.4)	5 (1.3)
Not being able to sleep or control worrying	172 (44.8)	206 (53.6)	6 (1.6)	0 (0.0)
Worrying too much about different things	91 (23.7)	215 (56.0)	68 (17.7)	10 (2.6)
Trouble relaxing	239 (62.2)	139 (36.2)	6 (1.6)	0 (0.0)
Being so restless that it is hard to sit still	308 (80.2)	74 (19.3)	2 (0.5)	0 (0.0)
Becoming easily annoyed or irritable	144 (37.5)	74 (19.3)	63 (16.4)	10 (2.6)
Feeling afraid, as if something awful might happen	321 (83.6)	167 (43.5)	1 (0.3)	0 (0.0)

**Figure 4: Overall level of anxiety disorder among overweight obese adult females, Taif city**

**Table 3: Association between socio-demographic characteristics of the overweight/obese adult females and level of anxiety disorder**

	Anxiety			p-value*
	Minimal N=263 N (%)	Mild N=118 N (%)	Moderate N=3 N (%)	
<b>Age (years)</b>				
18-25 (n=21)	15 (71.4)	6 (28.4)	0 (0.0)	
26-35 (n=40)	26 (65.0)	14 (35.0)	0 (0.0)	
36-40 (n=64)	44 (68.8)	19 (29.7)	1 (1.6)	
41-50 (n=136)	95 (69.9)	40 (29.4)	1 (0.7)	
>50 (n=123)	83 (67.5)	39 (31.7)	1 (0.8)	0.992
<b>Marital status</b>				
Single (n=32)	21 (65.6)	11 (34.4)	0 (0.0)	
Married (n=205)	148 (72.2)	57 (27.8)	0 (0.0)	
Divorced (n=70)	59 (84.3)	10 (14.3)	1 (1.4)	
Widowed (n=77)	35 (45.5)	40 (51.9)	2 (2.6)	<0.001
<b>Nationality</b>				
Saudi (n=331)	222 (67.1)	106 (32.0)	3 (0.9)	
Non-Saudi (n=53)	41 (77.4)	12 (22.6)	0 (0.0)	0.287
<b>Educational level</b>				
Illiterate (n=36)	21 (58.3)	15 (41.7)	0 (0.0)	
Primary school (n=14)	13 (92.9)	1 (7.1)	0 (0.0)	
Intermediate school (n=66)	47 (71.2)	19 (28.8)	0 (0.0)	
Secondary school (n=158)	111 (70.3)	45 (28.5)	2 (1.3)	
University/above (n=110)	71 (64.5)	38 (34.5)	1 (0.9)	0.400
<b>Occupation</b>				
House wife (n=311)	206 (66.2)	102 (32.8)	3 (1.0)	
Worker (n=73)	57 (78.1)	16 (21.9)	0 (0.0)	0.123
<b>Income (SR/month)</b>				
<5000 (n=19)	19 (100)	0 (0.0)	0 (0.0)	
5000-10000 (n=232)	145 (62.5)	87 (37.5)	0 (0.0)	
10001-15000 (n=129)	96 (74.4)	30 (23.3)	3 (2.3)	
>15000 (n=4)	3 (75.0)	1 (25.0)	0 (0.0)	0.001

\*Chi-square test

**Table 4: Association between body mass index of the females and level of anxiety disorder**

	Anxiety			p-value*
	Minimal N=263 N (%)	Mild N=118 N (%)	Moderate N=3 N (%)	
<b>Overweight (n=228)</b>	182 (79.8)	46 (20.2)	0 (0.0)	<0.001
<b>Obese (n=156)</b>	81 (51.9)	72 (46.2)	3 (1.9)	

\*Chi-square test

**Table 5: Medical factors associated with level of anxiety among adult overweight/obesity females**

	Anxiety			p-value*
	Minimal N=263 N (%)	Mild N=118 N (%)	Moderate N=3 N (%)	
<b>Chronic health problems</b>				<0.001
No (n=144)	120 (83.3)	24 (16.7)	0 (0.0)	
Yes (n=240)	143 (59.6)	94 (39.2)	3 (1.3)	
<b>Being on medication</b>				<0.001
No (n=147)	120 (81.6)	27 (18.4)	0 (0.0)	
Yes (n=237)	143 (60.3)	91 (38.4)	3 (1.3)	

\*Chi-square test

**Table 6: Predictors of anxiety among overweight/obese females:  
Regression logistic analysis**

	<b>B</b>	<b>SE</b>	<b>AOR</b>	<b>95% CI</b>	<b>p-value</b>
<b>Marital status</b>					
Single <sup>a</sup>			1.0		
Married	-1.613	0.502	0.20	0.07-0.53	0.001
Divorced	-2.766	0.620	0.06	0.02-0.21	<0.001
Widowed	0.058	0.575	1.06	0.34-3.27	0.919
<b>BMI</b>					
Overweight <sup>a</sup>			1.0		
Obese	0.914	0.271	2.49	1.47-4.24	0.001
<b>Chronic health problem</b>					
No <sup>a</sup>			1.0		
Yes	3.129	0.581	3.39	1.16-8.15	<0.001

**a: Reference category  
Adjusted odds ratio  
BMI: Body mass index**

**B: Slope SE: Standard error  
AOR: Adjusted odds ratio  
CI: Confidence interval**

**Terms of income and being on medication were not significant**

### Depression

Almost one-fifth of the participant reported that more than half of the days or nearly every day in the last 2 weeks they felt tired or having little energy (23.7%) and had trouble in falling or staying asleep, or sleeping too much (21.3%), On the other hand none of them had little interest or pleasure in doing things or had thoughts that they would be better off dead or of hurting themselves in some way in more than of days or nearly every day of the last two weeks. Table 7

Overall, the prevalence of depression was 46.6%; being mild among 35.7% and moderate or moderately severe among 10.9% of them. Figure 5

Depression was more significantly reported among women aged over 50 years ( $p=0.001$ ), ever married ( $p=0.001$ ), none-Saudi ( $p<0.001$ ), illiterates ( $p<0.001$ ), house wives ( $p<0.001$ ) and those with higher income ( $p<0.001$ ) compared to their peers. Severity of depression was variable with all studied socio-demographic factors. Table 8

Depression as well as moderate/moderately severe depression were more reported in obese females (74.1% and 22.5%, respectively compared to

overweight females (28.5% and 3.1%, respectively),  $p<0.001$ . Table 9

Depression as well as moderate/moderately severe depression were more reported in females with history of chronic diseases (54.6% and 14.2%, respectively compared to those without such history (33.3% and 5.2%, respectively),  $p<0.001$ . Also, depression as well as moderate/moderately severe depression were more reported in females with history of being on medications (54.0% and 13.5%, respectively compared to those without such history (34.7% and 6.8%, respectively),  $p<0.001$ . Table 10

Multivariate logistic regression analysis revealed that after controlling for confounders, obese females were at almost three folded risk for depression compared to overweight group (AOR=3.19; 95%CI=1.89-5.37,  $p<0.001$ . Other indicators for depression apart from BMI were non-Saudi nationality ( $p<0.001$ ), illiterate status ( $p$ -value ranged from 0.043 to 0.001), being house wife ( $p=0.005$ ) and having low income ( $p$  value ranged from 0.006-0.002). Table 11

Table 7: Response of the participants to the Patient Health Questionnaire (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things	264 (68.8)	120 (31.3)	0 (0.0)	0 (0.0)
Feeling down, depressed, or hopeless	116 (30.2)	219 (57.0)	41 (10.7)	8 (2.1)
Trouble falling or staying asleep, or sleeping too much	126 (32.8)	176 (45.8)	65 (16.9)	17 (4.4)
Feeling tired or having little energy	76 (19.8)	217 (56.5)	68 (17.7)	23 (6.0)
Poor appetite or overeating	201 (52.3)	152 (39.6)	15 (3.9)	16 (4.2)
Feeling bad about yourself — or that you are a failure or have let yourself or your family down	195 (50.8)	151 (39.3)	26 (6.8)	12 (3.1)
Trouble concentrating on things, such as reading the newspaper or watching television	273 (71.1)	107 (27.9)	3 (0.8)	1 (0.3)
Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	358 (93.2)	25 (6.5)	1 (0.3)	0 (0.0)
Thoughts that you would be better off dead or of hurting yourself in some way	377 (98.2)	7 (1.8)	0 (0.0)	0 (0.0)

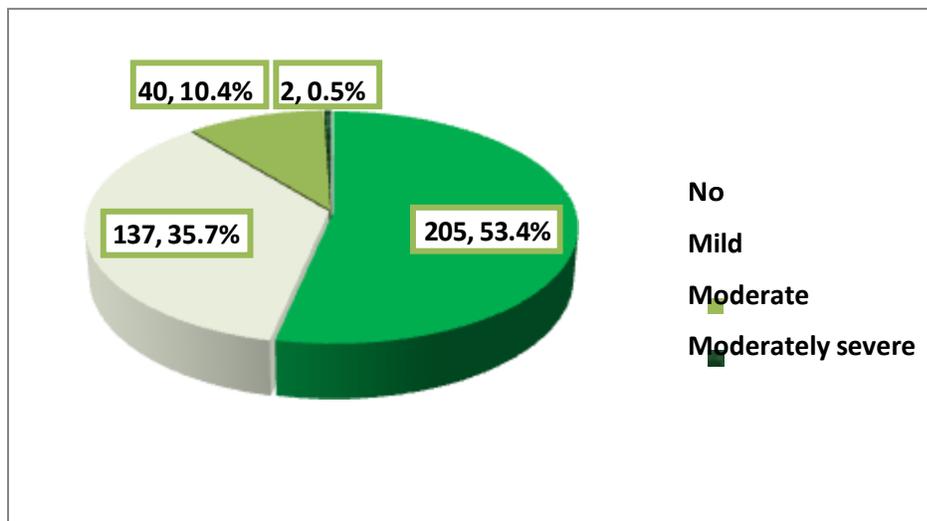


Figure 5: Prevalence of depression and its severity among the participants

**Table 8: Association between socio-demographic characteristics of the overweight/obese adult females and level of depression**

	Depression				p-value
	No N=205 N (%)	Mild N=137 N (%)	Moderate N=40 N (%)	Moderately severe N=2 N (%)	
<b>Age (years)</b>					
18-25 (n=21)	14 (66.7)	3 (14.3)	3 (14.3)	1 (4.8)	0.001
26-35 (n=40)	29 (72.5)	8 (20.0)	3 (7.5)	0 (0.0)	
36-40 (n=64)	38 (59.4)	25 (39.1)	1 (1.6)	0 (0.0)	
41-50 (n=136)	73 (53.7)	45 (33.1)	18 (13.2)	0 (0.0)	
>50 (n=123)	51 (41.5)	56 (45.5)	15 (12.2)	1 (0.8)	
<b>Marital status</b>					
Single (n=32)	22 (68.8)	6 (18.8)	4 (12.5)	0 (0.0)	0.001
Married (n=205)	103 (50.2)	84 (41.0)	17 (8.3)	1 (0.5)	
Divorced (n=70)	39 (55.7)	14 (20.0)	16 (22.9)	1 (1.4)	
Widowed (n=77)	41 (53.2)	33 (42.9)	3 (3.9)	0 (0.0)	
<b>Nationality</b>					
Saudi (n=331)	192 (58.0)	99 (29.9)	38 (11.5)	2 (0.6)	<0.001
Non-Saudi (n=53)	13 (24.5)	38 (71.7)	2 (3.8)	0 (0.0)	
<b>Educational level</b>					
Illiterate (n=36)	0 (0.0)	31 (86.1)	4 (11.1)	1 (2.8)	<0.001
Primary school (n=14)	12 (85.7)	2 (14.3)	0 (0.0)	0 (0.0)	
Intermediate school (n=66)	35 (53.0)	25 (37.9)	6 (9.1)	0 (0.0)	
Secondary school (n=158)	92 (58.2)	53 (33.5)	13 (8.2)	0 (0.0)	
University/above (n=110)	66 (60.0)	26 (23.6)	17 (15.5)	1 (0.9)	
<b>Occupation</b>					
House wife (n=311)	147 (47.3)	125 (40.2)	37 (11.9)	2 (0.6)	<0.001
Worker (n=73)	58 (79.5)	12 (16.4)	3 (4.1)	0 (0.0)	
<b>Income (SR/month)</b>					
<5000 (n=19)	18 (94.7)	1 (5.3)	0 (0.0)	0 (0.0)	<0.001
5000-10000 (n=232)	106 (45.7)	91 (39.2)	35 (15.1)	0 (0.0)	
10001-15000 (n=129)	80 (62.0)	42 (32.6)	5 (3.9)	2 (1.6)	
>15000 (n=4)	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)	

**Table 9: Association between body mass index of the females and depression**

	Depression				p-value
	No N=205 N (%)	Mild N=137 N (%)	Moderate N=40 N (%)	Moderately severe N=2 N (%)	
<b>Overweight (n=228)</b>	163 (71.5)	58 (25.4)	7 (3.1)	0 (0.0)	<0.001
<b>Obese (n=156)</b>	42 (26.9)	79 (50.6)	33 (21.2)	2 (1.3)	

**Table 10: Medical factors associated with depression among adult overweight/obesity females**

	Depression				p-value
	No N=205N (%)	Mild N=137 N (%)	Moderate N=40 N (%)	Moderately severe N=2 N (%)	
<b>Chronic health problems</b>					
No (n=144)	96 (66.7)	40 (27.8)	7 (4.9)	1 (0.3)	<0.001
Yes (n=240)	109 (45.4)	97 (40.4)	23 (13.8)	1 (0.4)	
<b>Being on medication</b>					
No (n=147)	96 (65.3)	41 (27.9)	9 (6.1)	1 (0.7)	0.002
Yes (n=237)	109 (46.0)	96 (40.5)	31 (13.1)	1 (0.4)	

**Table 11: Predictors of depression among overweight/obese females:****Regression logistic analysis**

	B	SE	AOR	95% CI	p-value
<b>Nationality</b>					
Saudi <sup>a</sup> Non-Saudi	1.519	0.423	1.0 4.57	1.99-10.47	<0.001
<b>Educational level</b>					
Illiterate <sup>a</sup>			1.0		
Primary school	-4.524	1.311	0.01	0.001-0.14	0.001
Intermediate school	-2.229	1.099	0.11	0.01-0.93	0.043
Secondary school	-3.305	1.048	0.04	0.001-0.29	0.002
University/above	-2.972	1.061	0.05	0.01-0.41	0.005
<b>Occupation</b>					
House wife <sup>a</sup>			1.0		
Worker (n=73)	-1.236	0.442	0.29	0.12-0.69	0.005
<b>Income (SR/month)</b>					
<5000 <sup>a</sup>			1.0		
5000-10000	3.302	1.099	27.17	3.15-234.17	0.003
10001-15000	3.094	1.135	22.02	2.39-204.10	0.006
>15000	5.072	1.672	159.42	6.02-4226.5	0.002
<b>BMI</b>					
Overweight <sup>a</sup>			1.0		
Obese	1.160	0.266	3.19	1.89-5.37	<0.001

<sup>a</sup>: Reference category  
odds ratio  
mass index

B: Slope SE: Standard error AOR: Adjusted  
CI: Confidence interval BMI: Body

Terms of age, marital status, chronic health problems and being on medication were not significant

## 5. DISCUSSION:

The physical burden of obesity is well established, however, its association with mental health is relatively less investigated.<sup>26</sup>The present study was conducted for the aim of evaluating the psychological impacts of depression and anxiety among women with high body mass index ( $\geq 25$  Kg/m<sup>2</sup>) attended primary healthcare centers in Taif city, western Saudi Arabia.

The prevalence of depression among overweight/obese women was 46.6% in the present study; being mild among 35.7% and moderate or moderately severe among 10.9% of them. Obesity was reported among 28.5% of overweight women compared to 73.1% of obese women. Other indicators for depression apart from BMI were non-Saudi nationality, illiterate status, being house wife and having low income. In a study carried out by Carey et al (2014), the prevalence of depression among overweight women was 16.4% whereas among obese women, it was 24.5%.<sup>27</sup> These figures are lower than those reported in the current study. However, comparison between the two studies should be interpreted in the light of using different tools in assessing depression as well as different demographic characteristics of the participants.

The present study documented that, even after controlling for the confounding effect, obese women were at higher risk for depression than overweight women. In the present study, we did not include normal subjects; however, we are expecting higher risk of depression among obese women compared to normal body mass index subjects. The same association between obesity and depression has been confirmed in other cross-sectional surveys,<sup>8, 10, 12, 28, 29</sup> and in meta-analysis of cohort studies carried out among adolescents with odds of developing depression in obesity as 1.4 and that of developing obesity among depressed subjects as 1.7.<sup>30</sup> In another meta-analysis study of cohort studies, the odds of being depressed among obese subjects was 1.55 and that of obesity among depressed subjects was 1.58.<sup>31</sup> In a prospective longitudinal study of 10 years, older women with obese subjects had 38% higher risk for developing depression and depressed subjects had 10% higher risk for obesity compared to controls (bidirectional relation).<sup>32</sup> On the other hand, Askari J et al found no association between obesity and depression.<sup>13</sup>

Population-based studies suggested a significant role for gender in the relationship between obesity and depression.<sup>3</sup> Also, a systematic review carried out by Rajan TM, Menon V. confirmed the association between obesity and depression with a stronger

association found in women.<sup>26</sup> Four prospective cohort studies done on adolescents and young adults showed that the risks of depression in obese persons were significantly higher in females.<sup>33-36</sup> This study was carried out solely among women, therefore we could not compare the effect of gender on the association between obesity and depression.

One study observed a moderate correlation ( $r = 0.49$ ) between depression severity and obesity indices.<sup>37</sup> A systematic review of epidemiological studies found a weak evidence for the increased risk of depression because of obesity.<sup>38</sup> In the current survey, obese women were at almost three folded risk for depression compared to overweight women. It has been documented that the body appearance is a mediating factor between overweight/obesity and depressive symptoms.<sup>9</sup>

In the current study, mild and moderate levels of anxiety were reported among 30.7% and 0.8% of the overweight/obese adult females, respectively while severe anxiety was not reported among any one and apart from BMI, single marital status and history of chronic diseases were significant predictors for anxiety among overweight/obese women. Recently, Sharafi SE et al (2020) reported that obesity/overweight was associated with the development of symptoms of anxiety and depressive symptoms irrespective of other factors. Also, anxiety and depression were observed to be associated with development of obesity, which suggest a bi-directional link between obesity and psychosocial status.<sup>39</sup>

The present study also revealed that, even after controlling for the confounding effect, obese women were at higher risk for anxiety than overweight women. Also, we did not include normal subjects; however, we are expecting higher risk of anxiety among obese women compared to normal body mass index subjects. Weak correlation ( $r = 0.083$ ) has been between obesity and anxiety in females in a study carried out in Nigeria by Ejike CE (2013)<sup>40</sup> and also in a study carried out by Guedes EP, et al (2013) in Brazil ( $r = 0.15$ ).<sup>41</sup> A mild association was also observed in a study carried out by Rajan TM and Menon V (2017).<sup>26</sup> However, in a systematic review and meta-analysis study carried out by Garipey G, et al (2017), a high association between obesity and anxiety disorder was observed (OR: 6.27).<sup>42</sup>

Limitations of the present study include the inclusion of only overweight and obese female subjects, therefore estimation of the prevalence of obesity and overweight among adult female population was impossible. However, the main aim of this study

is to assess the association between obesity from one side and anxiety and depression from the other side. The cross-sectional design is another important limitation of the study as a result of its inherited disadvantages as both cause and outcome are investigated at the same time. Lastly, height and weight of the participants in the present study were collected subjectively, so the accuracy of body mass index is questionable.

## 6. CONCLUSION:

Depression and anxiety are common psychiatric health problems among adult overweight/obese females. Obese females were at higher risk for both problems than overweight females. Apart from BMI, non-Saudi nationality, illiterate status, house wife status and having low income were indicators for depression among adult females. Also, apart from BMI, single marital status and history of chronic diseases were significant predictors for anxiety among overweight/obese women.

## 7. Recommendations:

According to the results of the present study, the following are recommended:

- Screening for depression and anxiety among overweight/obesity should be performed on regular basis at primary healthcare centers.
- Carry out a multidisciplinary program to manage overweight and obesity among females; including dietary counseling, encouraging physical activity, and psychiatric assessment.
- Special attention should be paid to low-socioeconomic status women, non-Saudis and those with chronic diseases.
- Further longitudinal study is needed to assess the temporal association between obesity and psychological health.

## 8. REFERENCES:

1. Baltacı G. Obesity and Exercise. Klasmat Press, Ankara, 2008.
2. WHO. Obesity: preventing and managing the global epidemic. Report of a WHO consultation, 2001. <https://www.ncbi.nlm.nih.gov/pubmed/11234459> (accessed 13 March 2016).
3. de Wit L, Luppino F, van Straten A, Penninx B, Zitman F, Cuijpers P. Depression and obesity: A meta-analysis of community-based studies. *Psychiatry Res.* 2010;178:230–5.
4. Druss BG, Rosenheck RA, Sledge WH. Health and disability costs of depressive illness in a major US corporation. *American Journal of Psychiatry* 2000; 157: 1274–1278.
5. Roberts RE, Deleger S, Strawbridge WJ, Kaplan GA. Prospective association between obesity and depression: evidence from the Alameda County Study. *International Journal of Obesity and Related Metabolic Disorders.* 2003;27: 514–521.
6. Wardle J, Cooke L. The impact of obesity on psychological well-being. *Best Practice & Research Clinical Endocrinology & Metabolism,* 2005;19(3): 421–440.
7. Carpenter KM, Hasin DS, Allison DB, Faith MS. Relationships between obesity and DSM-IV major depressive disorder, suicide ideation, and suicide attempts: results from a general population study. *American Journal of Public Health.* 2000; 90: 251–257.
8. Simon GE, Von Korff M, Saunders K, Miglioretti DL, Crane PK, vanBelle G, et al. Association between obesity and psychiatric disorders in the US adult population. *Arch Gen Psychiatry.* 2006;63:824–30.
9. Weinberger N-A, Kersting A, Riedel-Heller SG, Luck-Sikorska C. The relationship between weight status and depressive symptoms in a population sample with obesity: The mediating role of appearance evaluation. *Obes Facts.* 2018 Dec; 11(6): 514–523.
10. Jackson SE, Beeken RJ, Wardle J. Obesity, perceived weight discrimination, and psychological well-being in older adults in England. *Obesity (Silver Spring)* 2015 May;23(5):1105–11. doi:10.1002/oby.21052.
11. Choi Y, Choi E, Shin D, Park SM, Lee K. The Association between Body Weight Misperception and Psychosocial Factors in Korean Adult Women Less than 65 Years Old with Normal Weight. *J Korean Med Sci.* 2015 Nov; 30(11): 1558–1566. DOI: 10.3346/jkms. 2015.30.11.1558
12. Lee J-I, Yen C-F. Associations between body weight and depression, social phobia, insomnia, and self-esteem among Taiwanese adolescents. *Kaohsiung J Med Sci* 2014 Dec;30(12):625–30. doi: 10.1016/j.kjms.2014.09.005.
13. Askari J, Hassanbeigi A, Khosravi HM, Malekd M, Hassanbeigi D, ZahraPourmovahed Z, et al. The relationship between obesity and depression, 3rd World Conference on Psychology, Counselling and Guidance (WCPCG-2012), Procedia - Social and Behavioral Sciences 2013;84:796 – 800. doi.org/10.1016/j.sbspro.2013.06.649
14. Eliana M. Perrin et al, Perception of Overweight and Self-esteem During Adolescence *Int J Eat*

- Disord. 2010 Jul; 43(5): 447–454.
15. JafarAskaria et al, *Procedia - Social and Behavioral Sciences*, Volume 84, 9 July 2013, Pages 796-800
  16. Gary D. Foster, *Psychological Effects of Weight Cycling in Obese Persons: A Review and Research Agenda*, *Obesity A research Journal*, Volume5, Issue5 September 2012.
  17. Jane Wardle, *The impact of obesity on psychological well-being*, *Best Practice & Research Clinical Endocrinology & Metabolism*, Volume 19, Issue 3, September 2005, Pages 421-440
  18. Kelli E. Friedman, Simona K. Reichmann, Philip R. Costanzo and Gerard J. Musante. *Body Image Partially Mediates the Relationship between Obesity and Psychological Distress*. *Obesity A research Journal* Volume10, Issue1 January 2002 Pages 33-41
  19. Memish ZA *Obesity and Associated Factors — Kingdom of Saudi Arabia*, *Prev Chronic Dis*. 2014; 11: E174
  20. Carpenter KM, Hasin DS, Allison DB, Faith MS. *Relationships between obesity and DSM-IV major depressive disorder, suicide ideation, and suicide attempts: results from a general population study* *Am J Public Health*. 2000 February; 90(2): 251–257. Swinson RP. *The GAD-7 Scale was Accurate for Diagnosing Generalised Anxiety Disorder*. *Evid Based Med* 2006;11(6):184.
  22. Löwe B, Decker O, Müller S, Brähler E, Schellberg D, Herzog W, et al. *Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population*. *Medical care* 2008;46(3), 266.
  23. Kroenke K, Spitzer R, Williams W. *The PHQ-9: Validity of a brief depression severity measure*. *JGIM* 2001; 16:606-16.
  24. Liu SI, Yeh ZT, Huang HC, Sun FJ, Tjung JJ, Hwang LC, Shih YH, Yeh AW. *Validation of Patient Health Questionnaire for depression screening among primary care patients in Taiwan*. *Compr Psychiatry*. 2011;52(1):96-101.
  25. Belhadj H, Jomli R, Ouali U, Zgueb Y, Nacef F. *Validation of the Tunisian version of the patient health questionnaire (PHQ-9)*, 25<sup>th</sup> European Congress of Psychiatry. *European Psychiatry*. 2017; 41S: S521–S582. <http://dx.doi.org/10.1016/j.eurpsy.2017.01.695>
  26. Rajan TM, Menon V. *Psychiatric disorders and obesity: A review of association studies*. *J Postgrad Med*. 2017 Jul-Sep; 63(3): 182–190. doi: 10.4103/jpgm.JPGM\_712\_16
  27. Carey M, Small H, Yoong SL, Boyes A, Bisquera A, Sanson- Fisher R. *Prevalence of comorbid depression and obesity in general practice: a cross-sectional survey*. *British Journal of General Practice* 2014; 64 (620): 122-127. DOI: <https://doi.org/10.3399/bjgp14X677482>
  28. Zhong W, Cruickshanks KJ, Schubert CR, Nieto FJ, Huang GH, Klein BE, et al. *Obesity and depression symptoms in the Beaver Dam Offspring Study population*. *Depress Anxiety*. 2010;27:846–51.
  29. Kim JY, Chang HM, Cho JJ, Yoo SH, Kim SY. *Relationship between obesity and depression in the Korean working population*. *J Korean Med Sci*. 2010;25:1560–7.
  30. Mannan M, Mamun A, Doi S, Clavarino A. *Prospective associations between depression and obesity for adolescent males and females – A systematic review and meta-analysis of longitudinal studies*. *PLoS One*. 2016;11:e0157240.
  31. Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, et al. *Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies*. *Arch Gen Psychiatry*. 2010;67:220–9.
  32. Pan A, Sun Q, Czernichow S, Kivimaki M, Okereke OI, Lucas M, et al. *Bidirectional association between depression and obesity in middle-aged and older women*. *Int J Obes (Lond)* 2012;36:595–602.
  33. Richardson LP, Davis R, Poulton R, McCauley E, Moffitt TE, Caspi A, et al. *A longitudinal evaluation of adolescent depression and adult obesity*. *Arch Pediatr Adolesc Med*. 2003;157:739–45.
  34. Marmorstein NR, Iacono WG, Legrand L. *Obesity and depression in adolescence and beyond: Reciprocal risks*. *Int J Obes (Lond)* 2014;38:906–11.
  35. Herva A, Laitinen J, Miettunen J, Veijola J, Karvonen JT, Läksy K, et al. *Obesity and depression: Results from the longitudinal Northern Finland 1966 Birth Cohort Study*. *Int J Obes (Lond)* 2006;30:520–7.
  36. McCarty CA, Kosterman R, Mason WA, McCauley E, Hawkins JD, Herrenkohl TI, et al. *Longitudinal associations among depression, obesity and alcohol use disorders in young adulthood*. *Gen Hosp Psychiatry*. 2009;31:442–50.
  37. Ma J, Xiao L. *Obesity and depression in US women: Results from the 2005-2006 National Health and Nutritional Examination Survey*. *Obesity (Silver Spring)* 2010;18:347–53.

38. Atlantis E, Baker M. Obesity effects on depression: Systematic review of epidemiological studies. *Int J Obes (Lond)* 2008;32:881–91.
39. Sharafi SE, Garmaroudi G, Ghafouri M, Bafghi SA, Ghafouri M, Tabesh MR, et al. Prevalence of anxiety and depression in patients with overweight and obesity. *Obesity Medicine* 2020 Mar; 17: 100169. doi.org/10.1016/j.obmed.2019.100169
40. Ejike CE. Association between anxiety and obesity: A study of a young-adult Nigerian population. *J Neurosci Rural Pract.* 2013;4(Suppl 1):S13–8
41. Guedes EP, Madeira E, Mafort TT, Madeira M, Moreira RO, Mendonça LM, et al. Body composition and depressive/anxiety symptoms in overweight and obese individuals with metabolic syndrome. *Diabetol Metab Syndr.* 2013; 23:5–82.
42. Gariepy G, Nitka D, Schmitz N. The association between obesity and anxiety disorders in the population: A systematic review and meta-analysis. *Int J Obes (Lond)* 2010; 34:407–19.